CC 96-262 Bell Atlantic

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

James D. Schlichting, Chief
Competitive Pricing Division
Federal Communications Commission
Room 518
1919 M Street, N.W.
Washington, D.C. 20554

Dear Jim:

The attached Report of Bell Atlantic provides the material you requested relating to the impact of increased Internet usage on Bell Atlantic's network. As shown in the Report, Bell Atlantic surveyed representative central offices in the Washington, D.C. metropolitan area in which Internet Service Providers receive significant amounts of terminating traffic. The results are summarized in the Report and accompanying charts.

The cost impact figures that appear in the Report are close approximations, but they demonstrate the type of cross-subsidies that increased Internet use is causing, and can expected to cause in the future. Bell Atlantic will continue to refine its studies to provide additional data in the course of any future proceeding.

Please do not hesitate to contact me with any questions or for additional information.

Sincerely,

Joseph Mulieri (rm)

Attachment

REPORT OF BELL ATLANTIC ON INTERNET TRAFFIC

Bell Atlantic submits data today to assist the Commission staff in the evaluation of current arrangements which are available to Internet Service Providers (ISPs) to obtain access to their customers. Through the Enhanced Service Provider (ESP) exemption. ISPs are permitted to obtain their access services from local service tariffs. Local services are provided via network technology which was designed in anticipation of far different traffic characteristics than are currently being experienced. Bell Atlantic. through submission of these data. encourages the Commission to consider elimination of or modifications to the ESP exemption.

This submission is organized into five sections. The first section describes how the ISPs purchase services from Bell Atlantic today. including general information on prices for these services. The second section describes a traffic study which Bell Atlantic conducted on seven ISPs in the Virginia. Maryland and Washington. D.C area. The third section describes how ISP traffic loads have affected the network. The fourth section describes cost impacts. The final section describes suggestions as to how the FCC may address the issues raised by the ESP exemption. including a discussion on how correct economic pricing may provide better incentives for the ISPs to subscribe to services based technologies which can more efficiently handle ISP traffic patterns.

At the outset, Bell Atlantic views the recent development of the Internet, including use of the World Wide Web, as very positive for society and the telecommunications industry. While changes are needed to address problems caused by current access arrangements. we are committed to finding solutions which will sustain continued growth and interest in use of the Internet by the public at large. In fact, the changes Bell Atlantic is seeking to define, should help sustain growth by providing incentives for ISPs to embrace more efficient emerging technologies by eliminating artificial pricing arrangements that discourage use of improved technology. At the same time, Internet growth should not occur in ways that require cross-subsidization by non users of the Internet, or worse, lead to potential disruption of vital public safety services such as 911 emergency call service.

SECTION ONE - Current ISP Access Arrangements

ISPs currently use several interconnection arrangements purchased from local service tariffs to transport calls from their subscribers to their centrally located network aggregation centers. These network centers typically house modems, routers, WWW servers, authentication servers, mail servers, etc. Traffic collected at these network centers is routed to the Internet backbone over dedicated facilities, or to other on-line services. Placement of these centers often is a function of minimizing local access costs, i.e. maximizing the number of subscribers that can be reached on a flat rate, local call, untimed basis.

DDD Network Dial In Analog Access - Attachment 1

The most common interconnection arrangement is to use the existing DDD network to provide dial-in access to an analog "modem pool" for those customers who can reach the hub central office on a local call basis. The ISP's subscribers dial in to the lead number of the multiline hunt group serving the ISP, and the DDD network makes the connection. Depending upon the size of the multiline hunt group, and the features and functionality desired, many ISPs decide to purchase either Business Dial Tone Line, Engineered CENTREX or CustoFLEX 2100 from the hub central office.

The price for Business Dial Tone Line service in Virginia, for example (including Subscriber Line Charge), varies from a low of $16.93 to a high of $18.93 per month, per line. <u>There are no usage charges to the ISP since all traffic is incoming from the ISP's subscribers, and local tariffs contain no charges for terminating usage.</u>

Primary Rate ISDN Access - Attachment 2

In order to obtain additional functionality and higher transport speeds, and to reduce their costs of operation, many ISPs are beginning to purchase ISDN PRI (Primary Rate Interface) service. Each PRI facility is equipped to handle 24 circuits (in most cases one circuit is required for signaling). The price of an ISDN PRI facility in Virginia (including Subscriber Line Charge) is

$455.93 per month. Again, there are no usage charges billed to the ISP since all traffic is incoming from the ISPs subscribers.

SECTION TWO - Traffic Study

While field operations personnel report on a firsthand basis the effects of heavy traffic patterns associated with access into ISP facilities (see SECTION THREE below), we concluded that a more systematic approach to measuring traffic loads was needed to substantiate impact on our network. ISPs submit orders for local services (see SECTION ONE above) through our business offices in similar fashion to any other end user business customer, therefore their facilities cannot be separately identified for collection of usage data. Orders flow through our provisioning systems on a mechanized basis, and are not screened to enable identification of ISP facilities as such.

Thus the first step for the study was to ask the sales account teams in our Large Business Sales organization (the sales unit that has responsibility for the larger ISPs) to randomly select a number of ISPs who were known to have ordered service in the Virginia, Maryland, Washington, D.C. area. We selected these three jurisdictions due to the ready availability of trained personnel who had the knowledge of how to perform a usage study of the type required.

Even though calls from end users (for example, people dialing up over modems from their homes) increase traffic loads on the central offices that serve the end user, the heaviest concentration of traffic loads are occurring in the central offices that serve the ISPs. These central offices are where the earliest impacts on network resources are being observed. Therefore we selected lines from the ISPs that terminate into their serving central offices as the point at which to perform our traffic study.

We determined that by measuring traffic continuously over a 24 hour period for 7 days a week, for a period of four weeks we could obtain a meaningful sample of the overall impact within the region. Given that our computer systems were collecting information for each call made during this sample period, the quantity of data to be collected was quite large. Thus we determined that we did not want to exceed ten central offices and 5000 total circuits for this study, in order to manage the quantity of data that would be collected. The final study design resulted in selection of 7 ISPs in 9 central offices (5 in VA, 2 in MD and 2 in Washington, D.C.) and 4887 circuits. New circuits within a multiline hunt group ordered by each of the ISPs during the four week sample period were automatically added to the sample.

We selected a four week period (February 25 - March 23) to avoid holidays and other "events" that might lead to traffic spikes. Of the 4887 ISP circuits that we sampled, approximately half involved PRI connections, and the other half involved standard analog connections. The central offices selected varied in their mix of residential and business customers.

In addition to sampling ISP circuits, we also determined that it would be useful to have a benchmark traffic sample with which to compare results. Within the same 9 central offices, and during the same 4 week period, we selected 16 business/government customers having multline hunt groups serving multiple lines. We sampled a total of 777 lines for these 16 customers. As another benchmark, we also collected total usage for the 9 central offices during the 4 week sample period.

The output of the study was number of "hundred call seconds" (CCS) on an hourly basis. (There are 3600 seconds per hour, or 36 CCS if the line is used continuously during the hour). Our measuring system determined the time for each completed call per line, accumulated that usage on an hourly basis and converted the results into hourly CCS. For the peak hour of each segment studied, averaged over the four week period, the CCS results were as follows:

SAMPLE SEGMENT	AVERAGE PEAK HOUR CCS*	PEAK HOUR FOR SEGMENT
ISPs on 1MB (measured business)	26 CCS	11:00 PM
ISPs on PRI (primary rate interface)	28 CCS	10:00 PM
Business Customers with MLHG	12 CCS	5:00 PM
Office average (entire central office)	3 CCS	4:00 PM

* Maximum utilization is 36 CCS per hour

In order to provide a more visual display of results from the study, we selected Wednesday, March 13, and plotted the hourly CCS results for the four segments in each of the 9 central offices studied. The graphs are attached to this report. Names of both the customers and the central offices are masked to protect the privacy of our customers.

Another key output from the study was average length of completed calls. For the four week study period, the average length of all ISP calls was 17.7 minutes. This compares to approximately 4 to 5 minutes as the average for all other calls on our network.

The results of the study clearly demonstrate traffic levels for ISPs which are significantly above normal customer traffic levels. The results of our study also showed that the heavy traffic levels shown in the above table were consistent throughout the study period (See "Composite Graph For All 28 Days" attached), adding to our ability to conclude that this study provides a fair representation of the traffic levels which are occurring on our network attributable to ISP usage.

SECTION THREE - Network Impacts

In this section, we will describe the impact ISP traffic is having on our network.

Traffic engineers size switches based on an average usage assumption of about nine minutes per line during the peak hour (5CCS). Individual business customers may normally be in the range of 7 - 8 CCS. As our study demonstrated, traffic levels from ISPs greatly exceed this level, and approach 30 CCS in their peak hour. At the traffic levels they are generating, we estimate that the overall traffic loads on the local network would double if only a 15% penetration of households were connected to the Internet. Stated another way, if just 15% of households went on line to the Internet at one time and had a call hold time of one hour, it would double the capacity demanded. The reason is that 15% of households on line for an hour has the same effect as 100% of households making a nine minute call in that same hour (5CCS). With on-line data services, a relatively small user group can stress the network in ways which have not previously occurred, and were not contemplated in designing the network.

Heavy traffic loads affect certain elements of the network, the primary elements being Line Units (LU), Switch Modules (SM), and interoffice facilities (IOF). Subscriber lines terminate into LU's when analog services are ordered (e.g. 1MB). Under normal circumstances (i.e. traffic loads in the range of 3 - 5 CCS), each LU can accommodate approximately 450 subscriber lines, with a maximum capacity of 512 lines. As traffic loads on incoming lines increases, the number of lines which the LU can accommodate decreases. If all lines are at the 25 - 30 CCS level, then the LU can accommodate only about 65 subscriber lines. This would mean a 7-fold increase in the number of LUs needed to accommodate the same number of lines at an approximate cost of $60,000 per LU. Since there are 7 LUs per SM, investments in SMs will also increase. The need to add LUs and SMs exists even if ISP traffic peaks at a different time than the central office as a whole, because this equipment is dedicated to individual lines and cannot accept overflow traffic.

Interoffice facilities (IOF) requirements are also engineered to meet peak requirements. The peak busy hour for IOF trunks will vary throughout the network, and is influenced by community of interest factors associated with customers served by the central offices. The emergence of

Internet traffic has greatly increased the amount of IOF required to provide acceptable levels of service to all end users (regardless of whether PRI or analog lines are used). For example, the number of interoffice trunks in service for the switches in our traffic study increased 44% from June 1995 to June 1996 (a total of 16.585 trunks). Traditional growth expectations would have been in the range of 9% (3.397 trunks). The approximate capital cost of IOF is $1.350 per circuit. Thus an "above normal" investment of $17.8 million was required for the additional 13.188 IOF trunks for these 9 central offices.

Looking at recent experience in actual central offices helps to validate the argument that Internet traffic loads are adding to the cost of maintaining acceptable levels of telephone service for the public as a whole.

<u>A 5ESS Office Located in Northern Virginia Serving a Large ISP</u>

During the second half of 1994, this switch was running slightly above capacity due to higher than projected growth. The dial tone delay (percent of customers receiving delayed dial tone) varied between 0.54% and 0.78%, and the office experienced a busy hour of approximately 2.5 CCS between 15:30 and 16:30 hours. Network Administration rarely received trouble reports from field technicians and just an occasional call from the repair bureau.

Customer complaints about poor service began to increase substantially in February/March 1995. Trouble reports from field technicians increased from zero to in excess of 25 per month and a number of customer appeal cases were received. The situation had deteriorated to the point that one maintenance technician had to be assigned specifically to handle trouble reports. Investigations revealed that the ISP served out of that office was utilizing all available timeslots in various line equipment. This blocked access to the switch by basic residential and business customers. In February of 1995, dial tone delay had increased to 2.22%, as the ISP's lines in service grew rapidly. These lines were averaging 35.5 CCS at their busy hour, and had begun to shift the office busy hour to much later in the evening.

The decision was made to remedy the situation by dedicating certain central office equipment to the one ISP customer. Implementation of this strategy required the deployment of 6 switching module controllers, 1 digital line trunk unit, and 1 integrated digital carrier unit. This solution avoided blocking of normal residential and business calls. Even though effective, this solution has proven to be extremely expensive. The cost for switching equipment alone was $1.9M, and was five times the normal cost per line for office equipment. Labor expenses for rearranging lines were in excess of $100,000. By contrast, the revenue from the ISP for the lines affected was approximately $20,000 per month.

A 1AESS Office Located in Northern Virginia Serving An ISP

During the 1994/1995 busy season review this office was running well. The office overflow was averaging between 95.50 and 98.00 index each month. Busy hour CCS was averaging 3.21 during the busy season which was consistent with historical data for this office.

In Late December, 1995, the Network Administration Center received a trouble report for slow dial tone from the ISP. Subsequently, it was discovered that 50% of the ISPs lines were assigned to 2 line units which had been recently installed. These lines were averaging around 35 CCS during the evening hours, and 17 CCS over a 24 hour period. The office overflow increased from 14,000 in October 1995 to 73,600 in March 1996. The overall impact to the switch was to increase the busy hour CCS to 3.7, which represents a 15% increase in total switch demand.

Line and equipment transfers were performed to spread the ISP's access lines across multiple line units. All additional lines for the ISP have to be manually assigned to prevent overload conditions. An additional 312 interoffice trunks were also added to alleviate congestion in this part of the network.

Another 1AESS Office Located in Northern Virginia Serving An ISP

This office was traditionally one of the most trouble-free wire centers in Northern Virginia. The CCS per network access line was 2.56, and there were very few switch related trouble reports. The Network Switching Administration Group noticed a gradual increase in the "incoming matching loss" failures (calls incoming via trunks which are blocked in the switch) for the office in the fourth quarter 1995. Subsequently, "office overflow" failures (which is the sum of incoming and outgoing matching loss, as well as trunk overflow) increased from 2,445 to 21,000. This increase in failures was due to a substantial increase in call attempts and duration time incoming to the switch destined for the ISP multiline hunt group. The net effect of this activity was an increase in the average busy hour CCS to 3.11 and a shift in the busy hour to the early evening.

The fix again involved spreading lines over multiple line switches, which required transfer of many residential and business customers to provide additional switching capacity for the ISP's lines. The labor and capital expense to accommodate the ISP's traffic are in effect allocated across all other customers.

A 5ESS Remote Located In Maryland Serving An ISP

Remote offices such as this one are hosted from another office located nearby. During the 1994 busy season review, this remote office was equipped with 5 line units and 2050 working lines. The capacity was sufficient to handle normal growth expectations. The dial tone delay was 0.09%, office overflow was 0.18% and the busy hour was 15:30 - 16:30.

In February 1995 numerous customer complaints associated with slow dial tone were experienced. An investigation revealed the cause of the problem was traffic destined to the ISP served out of this office. Heavy utilization of these access lines had driven CCS up to 3.18, as well as increasing dial tone delay to 0.40% and office overflow to 1.09% during the normal busy hour of 15:30 - 16:30. ISP traffic had shifted the busy hour to 20:00 - 21:00, with CCS exceeding 4.0. with a dial tone delay of 14.3% and office overflow which approached 19%. Switch capacity was exhausted.

The conclusion was reached that remote switching centers could not be equipped to support the demand generated by an ISP. Therefore the decision was made to rehome the ISPs lines directly to the host switch. Approximately $200.000 in capital was expended to implement this strategy due to the fact that a new digital loop carrier terminal was required in the host office. so that the ISP's lines could be spread across multiple line units. thereby lessening the overall CCS impact to the office.

A Northern Telecom DMS-100 In Maryland Serving An ISP

This wire center contained strictly analog line units with limited spare floor space which did not allow a building addition. As the ISP traffic rapidly increased, it became evident that this office would be unable to support this growing traffic requirement. It was determined that the only feasible solution was to home all growth lines for the ISP to another office via a digital loop carrier system . The cost of this facility was approximately $300K. Since revenues from this ISP are about $15,000 per month, it will take at least 20 months to recover just this one equipment item, not addressing all remaining equipment and labor costs required to serve the customer.

SECTION FOUR - Cost Impacts

Traditional cost models designed for general ratemaking across all customer segments do not have the ability to identify and attribute costs specifically to ISPs. However, information derived from our network engineers can be used to generally illustrate the conclusion that current revenues derived from local services provided to ISPs do not come close to recovering the cost of providing service. Hence a cross subsidization is occurring between users of ISP services and all other users.

The network elements most affected by heavy traffic loads from ISPs are line units, switch modules and interoffice trunking. Per subscriber line served, these units generally result in a capital cost of approximately $245. This assumes the normal traffic load of 3 to 4 CCS. However, as CCS approaches 30, the capital costs for these units approaches $2400 per subscriber line, because of the reduced number of lines they can serve and the increase in interoffice traffic. As shown below, this translates into an approximate monthly cost per subscriber line of $75, compared to the average tariff rate of about $17 per month. Preliminary studies show that the comparable monthly cost per subscriber line for PRI circuits is estimated to be $50.

For illustrative purposes, we have attempted to size this for our entire network as follows. We estimate that during 1996, ISP circuits will average 40,000 throughout our region. (This is estimated based on input from sales organizations, as system databases do not specifically identify ISP circuits. and ISPs themselves often do not identify themselves as being ISPs. Since ISP circuits are growing very rapidly. the end of year total will significantly exceed the beginning of year total.) Roughly half of the circuits are analog lines (e.g. 1MB) and half are PRI.

The $2400 in capital costs for what in effect are traffic sensitive investments can be converted to a rough monthly cost by utilizing a standard annual cost factor of .37 (source: our network engineering organization). This annual cost factor is a shorthand way to incorporate overheads. maintenance. depreciation, etc. This results in approximately $900 in annual costs. or roughly $75 per month per ISP analog line.

Utilizing the 40.000 average ISP circuit count (roughly 50% analog and 50% PRI) and the estimated monthly cost per circuit ($75 cost per month per analog line and $50 per month per PRI). the total estimated cost of serving ISPs in 1996 is $30 Million. Assuming average revenue from ISPs for these lines was $17 per month per line, total revenues from this segment in 1996 for public switched network service would be $8.2 Million. Thus there is a cross subsidy of approximately $22 Million for 1996. Assuming an annual growth rate of 40% for illustrative purposes. this cross subsidy would grow to approximately $120 Million in five years.

The above calculations are presented to provide current insight into the dimensions of the issues raised in this report, and are based on broad averages across our region. We will continue to fine-tune our understanding of the cost issues and collect data which result in increased accuracy.

SECTION FIVE - ESP Exemption and Incentives for Adopting New Technology

Perhaps the most significant shortcoming of existing service arrangements provided to ISPs is the flat rate per month. For about $17 per month, an ISP can utilize lines from the public switched network that can be literally filled to capacity. Increasingly, ISPs are moving to charge their subscribers flat rate prices as competition within their industry accelerates. Flat rate prices, and the nature of on-line communications has resulted in call characteristics for computer-type "calls" which vary significantly from traditional voice calls. The flat rate price encourages users to connect, and stay connected throughout the day (and evening). Applications such as voice over the Internet can be most effective if the user's Internet connection stays on all the time. In effect, a circuit-switched architecture has been converted to a private line - as a result of the pricing signal we are sending. Neither end users nor ISPs have sufficient incentive to utilize public switched network resources efficiently.

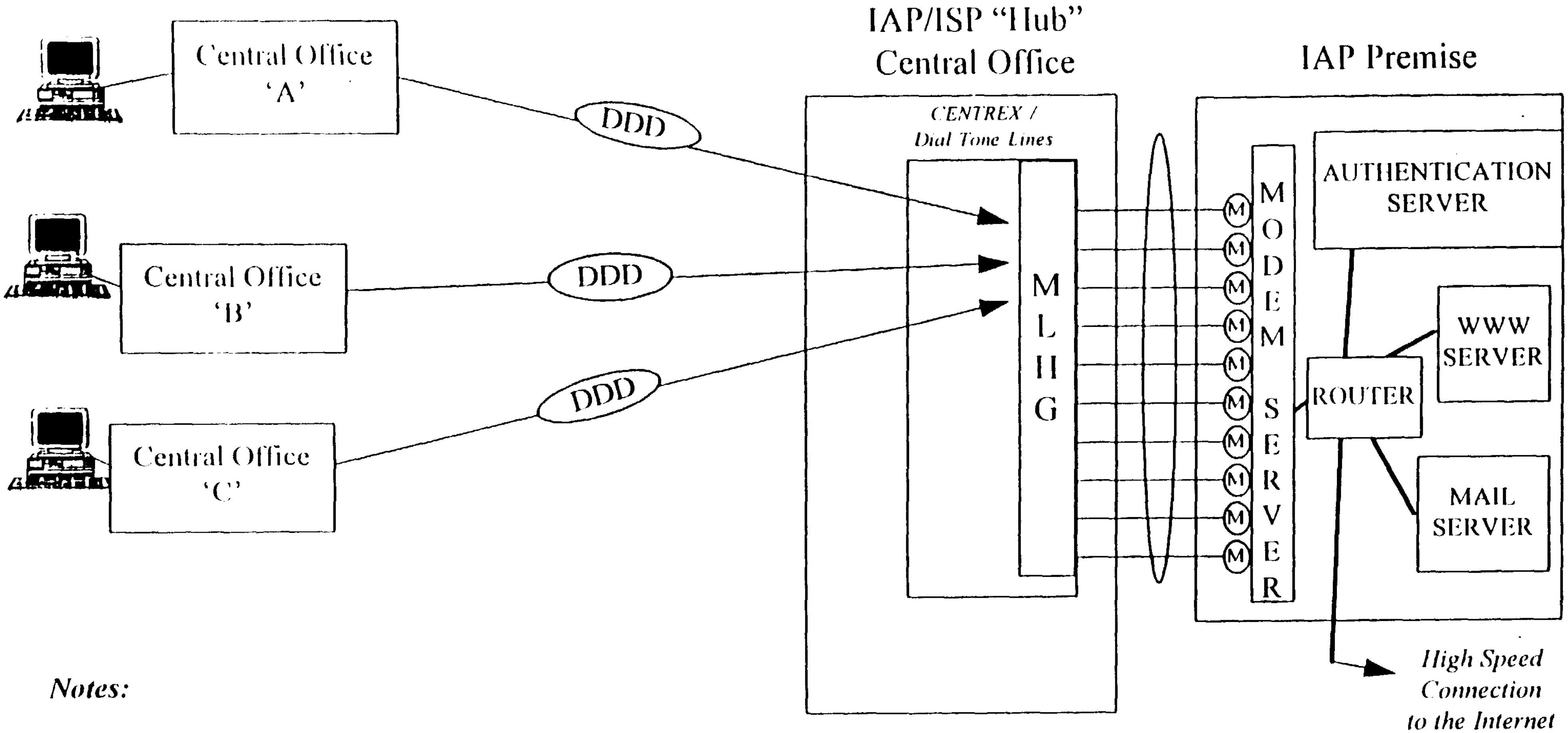
Another consequence of today's pricing signal is to retard the adaptation of more appropriate technologies. Since data transmissions are generally more tolerant of minor delays than voice services, a packet technology is particularly well suited to the transmission of Internet-type communications. Bell Atlantic has introduced a service called Internet Protocol Routing Service (IPRS), which utilizes SMDS to transport calls. In addition to providing more efficient transport of Internet-type calls, this service would assist the circuit-switched network used for voice calls by alleviating congestion at the central offices that serve ISPs. With IPRS, traffic will be collected at many originating end offices and transported directly to ISP offices. Other technologies are on the drawing board which could both provide better service to end users, and help alleviate congestion on the public switched network.

However, as long as current pricing arrangements are in effect (i.e. the ESP exemption), the time it takes for these technologies to be adopted is artificially lengthened. The ISPs in our traffic study generated on March 13 (the same day selected for the graphs attached to this report) 608 minutes of use per line over the 24 hour period. Based on payment of $17 per month per line, the ISPs pay 56 cents per day, or $.0009 per minute of use. This contrasts with Bell Atlantic's interstate switched access charge of approximately 2 cents per minute. In effect, ISPs are paying 1/22 of the equivalent per minute rate paid by IXCs during a business day. At these levels, ISPs would have little incentive to adopt voluntarily alternative forms of access.

A usage sensitive price (related to the traffic sensitive costs in our local network) is needed to send the appropriate signal to use the public switched telephone network efficiently. However, we recognize that this price must be at a level which does not cause disruption in the industry. As stated at the outset of this report, Bell Atlantic will work with the Commission and industry participants to come up with pricing options that help to moderate existing cross subsidies, and help send the type of economic signal that will aid in allowing the faster adaptation of technologies which will help alleviate growing congestion on the local telephone network, but which will also not lead to undue disruption in the industry.

As an important first step, we applaud the Commission's invitation to provide this information which establishes the dimensions of the problems we are experiencing, and we encourage the Commission to take the next step of requesting broader input. The problems we have experienced thusfar, while severe in our view, have not been recognized by the public at large. Given the rapid, and almost volatile, growth of traffic related to serving ISPs, however, it is not difficult to envision scenarios whereby traffic surges might occur which would overwhelm the ability of local networks to sustain service. Service interruptions of even a temporary length could affect public safety services such as 911 service, with unthinkable consequences. Therefore it is important for the Commission to address quickly the issues raised in this report.

Using the DDD Network to Connect Incoming Callers to an Internet Access Provider - - - - - - - - - - - - - - *Attachment 1*

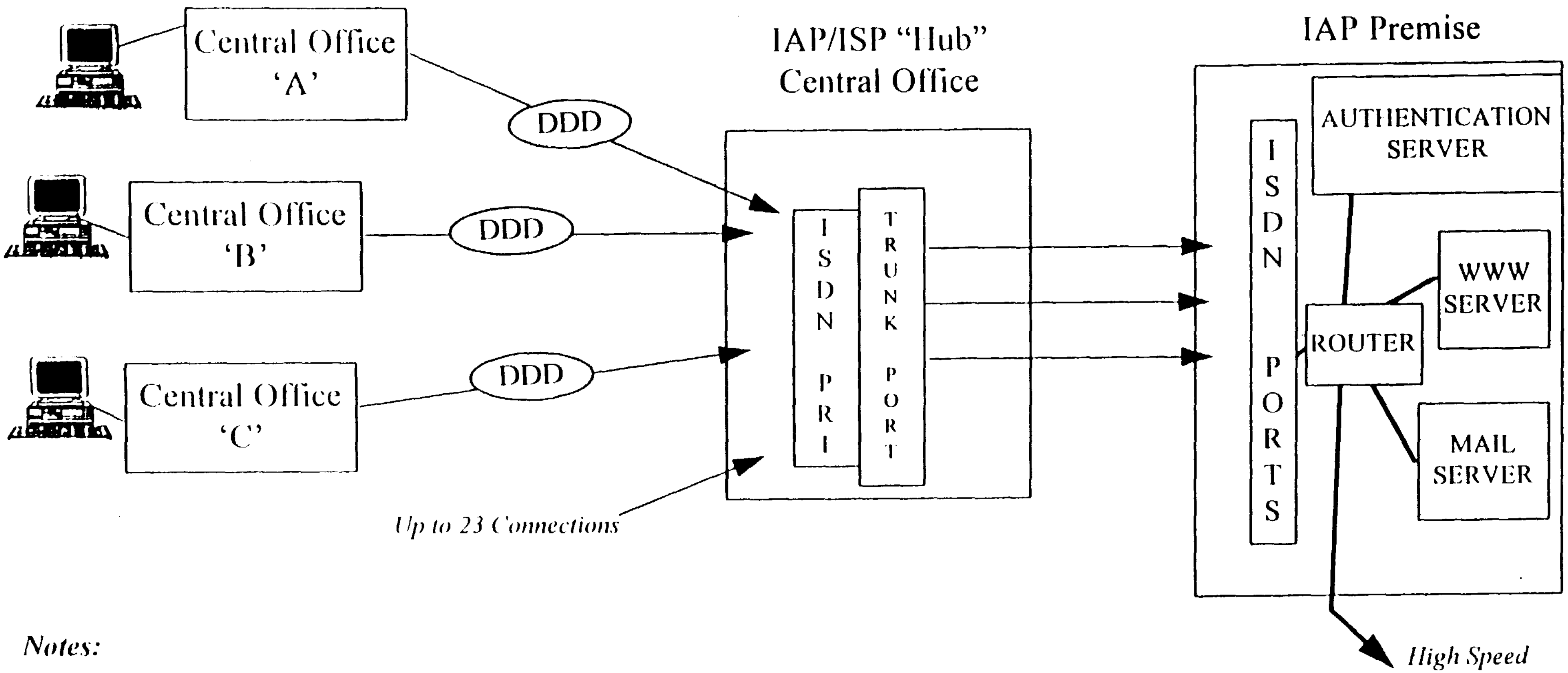


Notes:

1 - The IAP/ISP usually purchases *CENTREX* or Dial Tone Lines at the Serving Central Office, placing all of the modem access lines in a large, single lead number accessible, Multi-Line Hunt group (MLHG). The number of lines in the MLHG is set to provide a predictable level of service during the IAP/ISP's busy hour.

2- The IAP/ISP's customers would pay any applicable network usage charges. Since many customers call over flat rated facilities, most often there are no usage charges involved.

Access to Internet Access Provider via ------------------------- Attachment 2
ISDN Primary Rate (PRI) Service



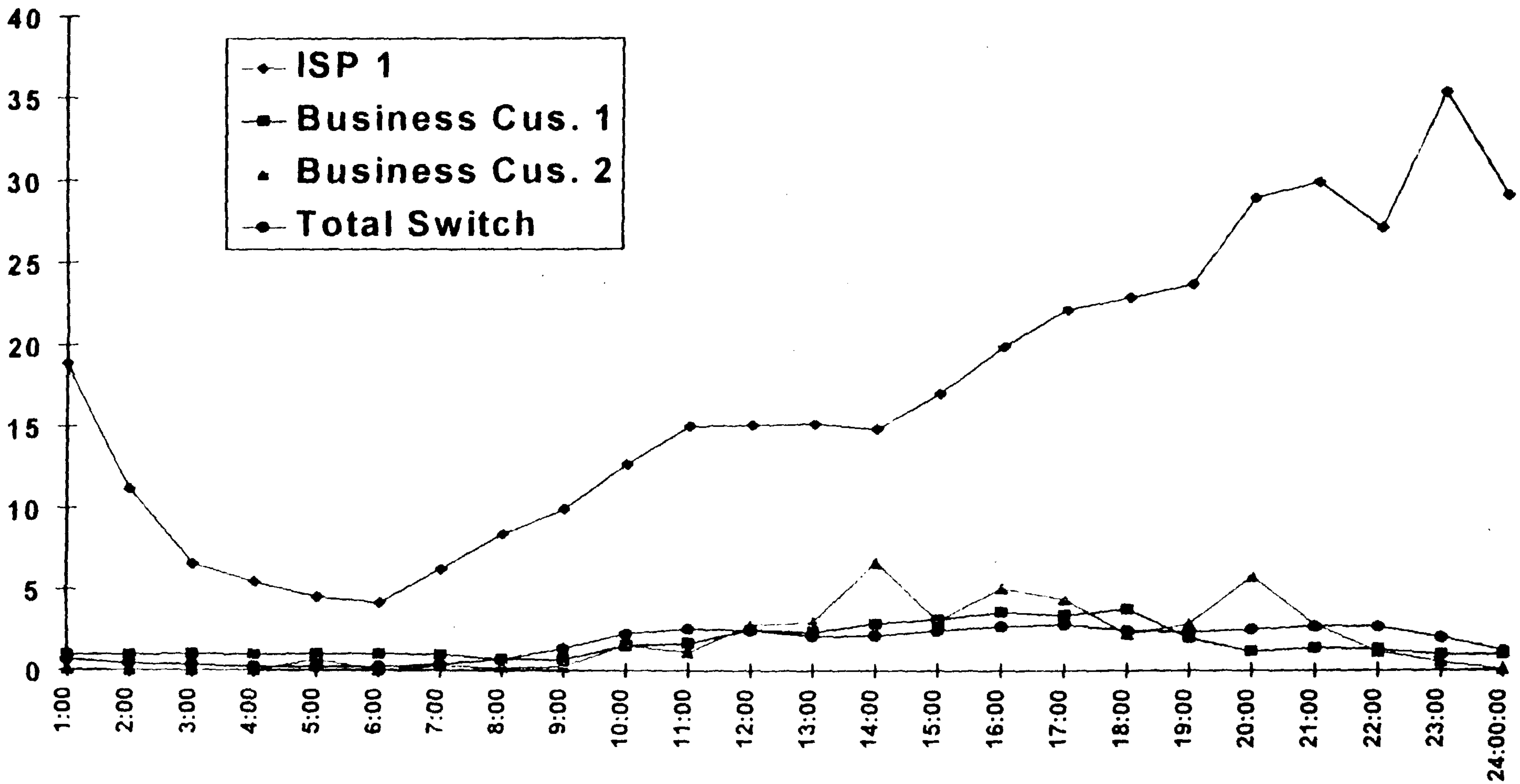
Notes:

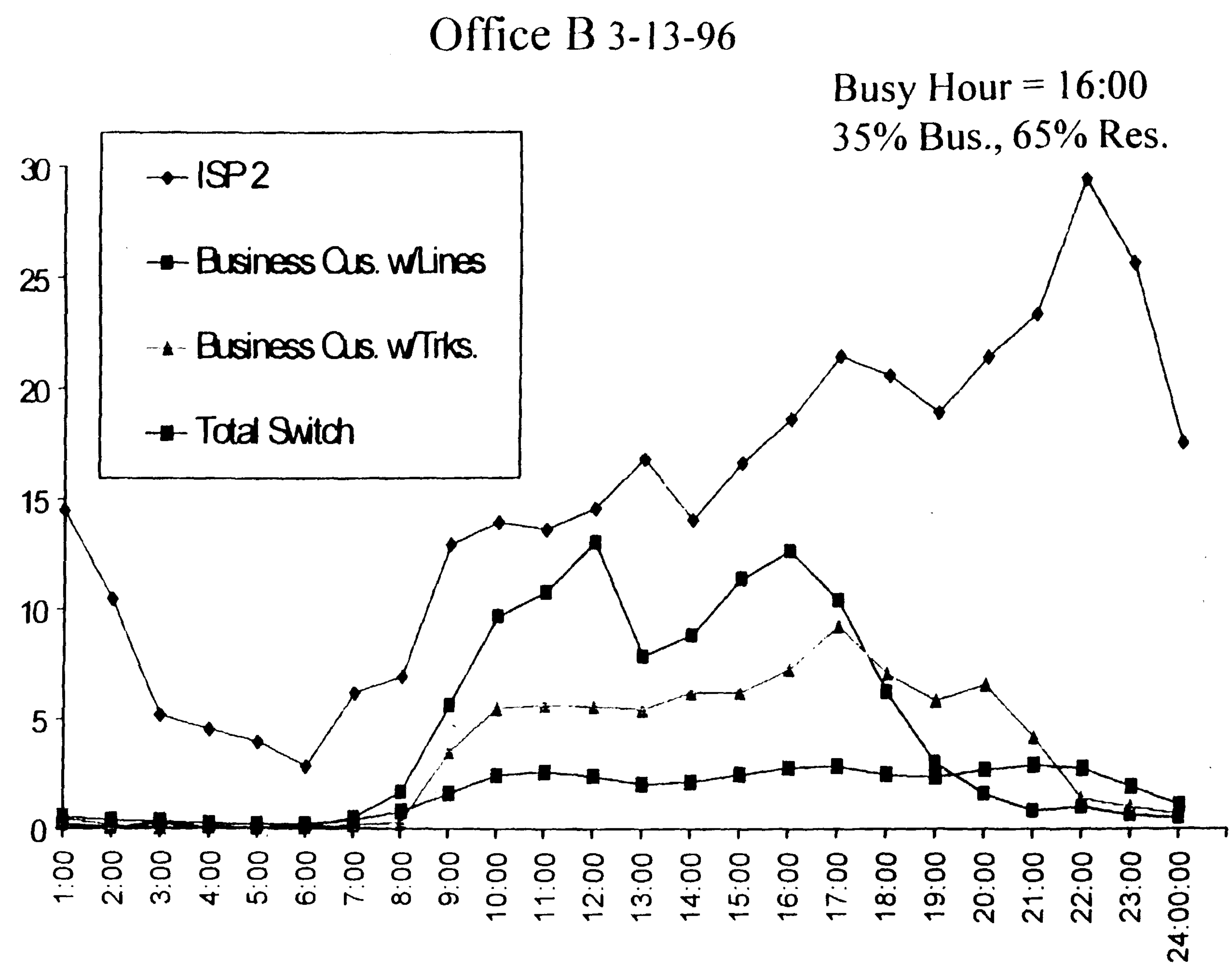
1 - The IAP/ISP purchases ISDN PRI facilities at the Serving Central Office. Each PRI facility will support up to 23 simultaneous dial in analog or ISDN Basic Rate Interface connections with the 24th channel providing signaling. Additional PRIs used in a hunt group can support 24 simultaneous calls each.

2 - The IAP/ISP's customers would pay any applicable network usage charges. Since many customers

Office A 3-13-96

Busy Hour = 16:00
33% Bus., 67% Res.




Office B 3-13-96
Busy Hour = 16:00
35% Bus., 65% Res.
ISP 2
Business Cus. w/Lines
Business Cus. w/Trks.
Total Switch
0
5
10
15
20
25
30
1:00
2:00
3:00
4:00
5:00
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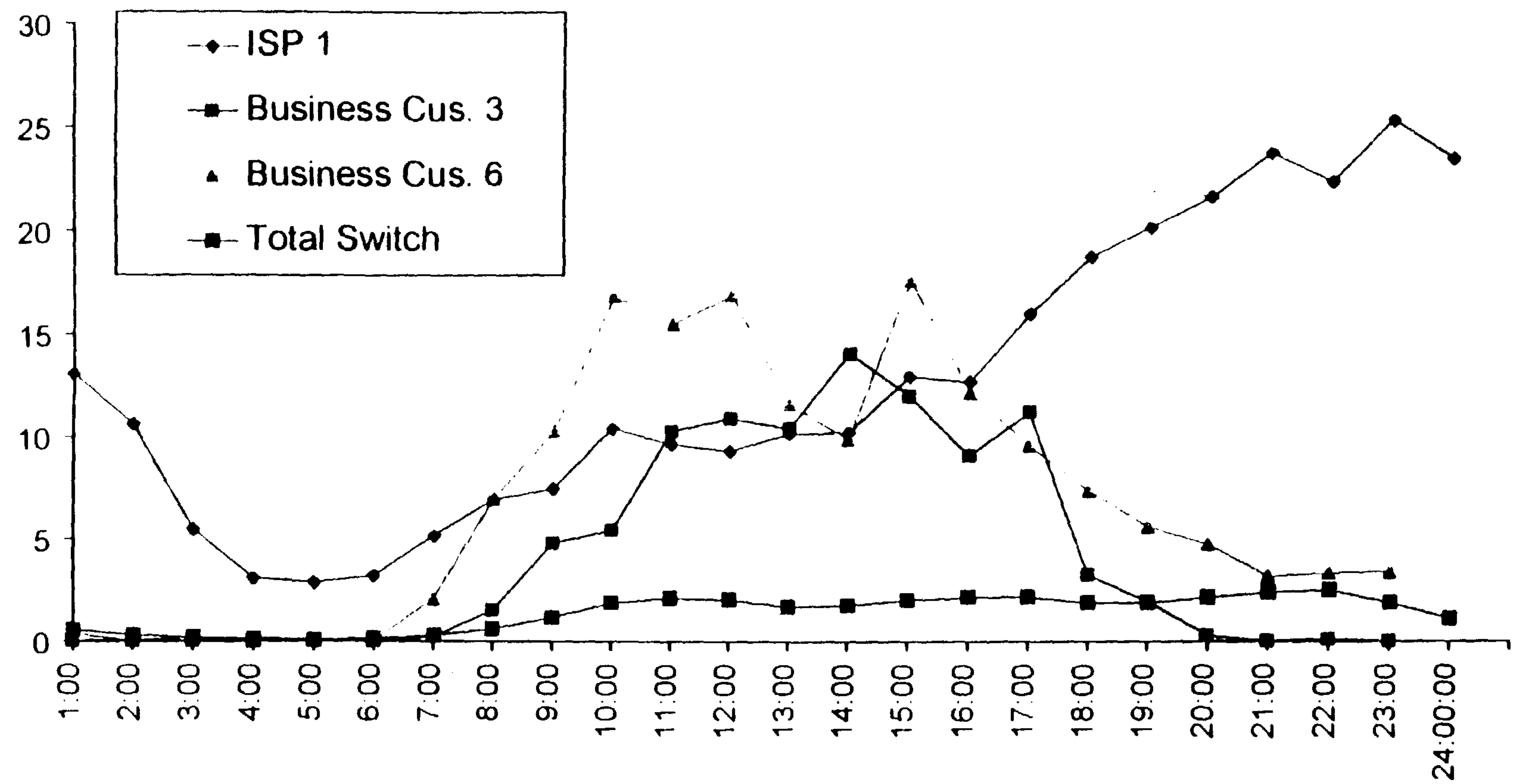
Office C 3-13-96

Busy Hour = 16:00
40% Bus., 60% Res.



Office D 3-13-96

Busy Hour = 16:00
40% Bus., 60% Res.